

Amendments to the Claims

Please amend Claims 1, 12, 24, 36, 42 and 48-50. The Claim Listing below will replace all prior versions of the claims in the application:

Claim Listing

1. (Currently Amended) A charge pump circuit comprising:
charge pumping capacitance;
switches that vary voltage across the pumping capacitance to provide a pumped output voltage from an input voltage;
variable resistance that limits noise generating current spikes through the charge pumping capacitance during switch transitions; and
control that varies the variable resistance with varied operating point.
2. (Original) A charge pump as claimed in claim 1 wherein the variable resistance is coupled in series with the pumping capacitance and input voltage.
3. (Original) A charge pump as claimed in claim 1 wherein the variable resistance comprises a switch coupled in parallel with a resistor.
4. (Original) A charge pump as claimed in claim 3 wherein the switch is a field effect transistor.
5. (Original) A charge pump as claimed in claim 3 wherein the control comprises a comparator.
6. (Original) A charge pump as claimed in claim 3 wherein the control comprises an amplifier.
7. (Original) A charge pump as claimed in claim 3 wherein the control comprises a shunt reference device.

8. (Original) A charge pump as claimed in claim 1 wherein the variable resistance comprises a field effect transistor.
9. (Original) A charge pump as claimed in claim 1 wherein the control comprises a comparator.
10. (Original) A charge pump as claimed in claim 1 wherein the control comprises an amplifier.
11. (Original) A charge pump as claimed in claim 1 wherein the control comprises a shunt reference device.
12. (Currently Amended) A controller comprising:
 - charge pumping capacitance;
 - switches that vary voltage across the pumping capacitance to provide a pumped output voltage from an input voltage;
 - variable resistance that limits noise generating current spikes through the charge pumping capacitance during switch transitions; and
 - control that varies the variable resistance with varied operating point.
13. (Original) A controller as claimed in claim 12 comprising both a charge pump internal to a controller integrated circuit and an external charge pump.
14. (Original) A controller as claimed in claim 12 wherein the variable resistance is coupled in series with the pumping capacitance and input voltage.
15. (Original) A controller as claimed in claim 12 wherein the variable resistance comprises a switch coupled in parallel with a resistor.

16. (Original) A controller as claimed in claim 15 wherein the switch is a field effect transistor.
17. (Original) A controller as claimed in claim 15 wherein the control comprises a comparator.
18. (Original) A controller as claimed in claim 15 wherein the control comprises an amplifier.
19. (Original) A controller as claimed in claim 15 wherein the control comprises a shunt reference device.
20. (Original) A controller as claimed in claim 12 wherein the variable resistance comprises a field effect transistor.
21. (Original) A controller as claimed in claim 12 wherein the control comprises a comparator.
22. (Original) A controller as claimed in claim 12 wherein the control comprises an amplifier.
23. (Original) A controller as claimed in claim 12 wherein the control comprises a shunt reference device.
24. (Currently Amended) A DC/DC converter comprising:
 - controlled switches; and
 - a controller that controls the controlled switches, the controller comprising:
 - charge pumping capacitance;
 - switches that vary voltage across the pumping capacitance to provide a pumped output voltage to the controller from an input voltage;

variable resistance that limits noise generating current spikes through the charge pumping capacitance during switch transitions; and

control that varies the variable resistance with varied operating point.

25. (Original) A DC/DC converter as claimed in claim 24 comprising both a charge pump internal to a controller integrated circuit and an external charge pump.
26. (Original) A DC/DC converter as claimed in claim 24 wherein the variable resistance is coupled in series with the pumping capacitance and input voltage.
27. (Original) A DC/DC converter as claimed in claim 24 wherein the variable resistance comprises a switch coupled in parallel with a resistor.
28. (Original) A DC/DC converter as claimed in claim 27 wherein the switch is a field effect transistor.
29. (Original) A DC/DC converter as claimed in claim 27 wherein the control comprises a comparator.
30. (Original) A DC/DC converter as claimed in claim 27 wherein the control comprises an amplifier.
31. (Original) A DC/DC converter as claimed in claim 27 wherein the control comprises a shunt reference device.
32. (Original) A DC/DC converter as claimed in claim 24 wherein the variable resistance comprises a field effect transistor.
33. (Original) A DC/DC converter as claimed in claim 24 wherein the control comprises a comparator.

34. (Original) A DC/DC converter as claimed in claim 24 wherein the control comprises an amplifier.
35. (Original) A DC/DC converter as claimed in claim 24 wherein the control comprises an shunt reference device.
36. (Currently Amended) A method of charge pumping comprising:
varying voltage across a pumping ~~capacitor~~ capacitance to provide a pumped output voltage from an input voltage; and
varying variable resistance in circuit with the pumping capacitance with varied operating point to limit noise generating current spikes through the pumping capacitance during switch transitions.
37. (Original) A method as claimed in 36 wherein the variable resistance is coupled in series with the pumping capacitance and input voltage.
38. (Original) A method as claimed in 36 wherein the variable resistance comprises a field effect transistor.
39. (Original) A method as claimed in 36 wherein the variable resistance is varied in response to a comparator.
40. (Original) A method as claimed in 36 wherein the variable resistance is varied in response to an amplifier.
41. (Original) A method as claimed in 36 wherein the variable resistance is varied in response to a shunt reference device.
42. (Currently Amended) A method of converting DC voltage to DC voltage comprising:

varying voltage across a pumping ~~capacitor~~ capacitance to provide a pumped output voltage from an input voltage;

varying variable resistance in circuit with the pumping capacitance with varied operating point to limit noise generating current spikes through the pumping capacitance during switch transitions;

applying the output voltage to a controller; and

controlling converter switches from the controller.

43. (Original) A method as claimed in 42 wherein the variable resistance is coupled in series with the pumping capacitance and input voltage.
44. (Original) A method as claimed in 42 wherein the variable resistance comprises a field effect transistor.
45. (Original) A method as claimed in 42 wherein the variable resistance is varied in response to a comparator.
46. (Original) A method as claimed in 42 wherein the variable resistance is varied in response to an amplifier.
47. (Original) A method as claimed in 42 wherein the variable resistance is varied in response to a shunt reference device.
48. (Currently Amended) A charge pump comprising:
 - means for varying voltage across a pumping ~~capacitor~~ capacitance to provide a pumped output voltage from an input voltage; and
 - means for varying variable resistance in circuit with the pumping capacitance with varied operating point to limit noise generating current spikes through the pumping capacitance during switch transitions.

49. (Currently Amended) A controller comprising:
- means for varying voltage across a pumping ~~capacitor~~ capacitance to provide a pumped output voltage from an input voltage; and
 - means for varying variable resistance in circuit with the pumping capacitance with varied operating point to limit noise generating current spikes through the pumping capacitance during switch transitions.
50. (Currently Amended) A DC/DC converter comprising:
- means for varying voltage across a pumping ~~capacitor~~ capacitance to provide a pumped output voltage from an input voltage;
 - means for varying variable resistance in circuit with the pumping capacitance with varied ~~input voltage~~ operating point to limit noise generating current spikes through the pumping capacitance during switch transitions;
 - means for applying the output voltage to a controller; and
 - means for controlling converter switches from the controller.